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ABSTRACT

The Total Performance System (TPS) concept, a conceptual tool to aid management of a wide variety of complex systems such as classrooms, courses, schools, and businesses is presented as a unit of analysis for systems approaches to educational and management problems. A description of the TPS concept defines the classroom as a processing system with inputs (students) and outputs (graduates), and an internal feedback loop to guide educational processes. That description is criticized as incomplete and an alternative total performance system is suggested which adds a receiving system (to receive the graduates and any other outputs) and an external feedback loop (to call attention to interactions between the classroom and its environment and to the ultimate validation and evaluation of internal feedback measurements by external feedback). Use of the TPS concept is illustrated through application to curriculum and organization development problems including data from a classroom management project utilizing the TPS concept. (Author)

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# The Total Performance System:

## Applications to Classrooms and Other Organizations

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# The Total Performance System:

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The telephone companies comprising AT&T have a television spot that carries this message: "The system is the solution." If individuals or businesses need rapid data transmission, rapid voice communication, or rapid visual communication, "The system is the solution."

Most of us spend most of our lives within a few yards of a telephone. One end of the wire attached to my 'phone is attached to your 'phone. And to millions upon millions of other telephones in this country, in Canada, in Japan, in Australia, in Venezuela, in almost any part of the world.

"The system is the solution," to many communication problems

My message to you is very similar: "The system is the solution." "The Total Performance System is the solution."

The Total Performance System concept just might be a solution to a problem that is important to you. And what kind of problem might that be? To what problems is the TPS a solution?

In one sense, absolutely none. It is a tool, not a solution. Similarly, the telephone system is not really a solution to anything. It is a tool. It has to be used properly to facilitate solutions. The TPS concept is a tool. It is not a <u>thing</u> tool, as a hammer or a telephone is a thing tool; it is a <u>conceptual</u> tool. Used properly, it can be very valuable. It is not magic, it does not work by itself, but it is something we can use to guide some important activities.

It is an aid in managing complex systems such as human service agencies, schools, courses, lessons, therapeutic plans, therapeutic programs, government agencies, advertising campaigns, retail businesses, professional organizations, manufacturing businesses, public relations campaigns, recruiting efforts, organizational development activities, personnel departments, accounting departments, physics departments, psychology departments, concerts, conventions, and public speeches, to name just a few.

Claiming that one concept can be used to systematize and guide such a variety of activities is a strong claim. Let me make an even stronger claim, namely that the TPS is a unit of analysis for doing systems analysis akin in power, precision, and generality to the contingency of reinforcement as a unit for doing behavioral analysis. Furthermore, the TPS concept is one which closely related to, dovetails with, and compliments the contingency of reinforcement.

Let me say that I cannot, today, "prove" these claims. I am trying instead for a lesser goal of showing that I am not entirely daft for making them. I am trying for a more important goal of stimulating efforts to see if the claims pay off in real, or in fool's, gold.

So---what is the concept and how can it be used?

Just as one does behavioral analysis by drawing S's and R's, one does systems analysis by drawing oddly shaped boxes and arrows. Begin by drawing a rectangle about two inches long and an inch high. The rectangle represents the boundary of the system and, like Pandora's box, it contains all the problems of the system neatly tucked away inside until some foolish person lifts the lid.

Most living systems (e.g., persons, classrooms, and businesses) have semipermeable boundaries which let some things in and let others

out. Draw an arrow into the left side of the rectangle and call it an input. Draw an arrow out of the right side and call it an output.

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Insert Figure 1 about here.

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For purposes of illustration, label the box: "Classroom"; the inputs: "Students"; and the outputs: "Graduates". You have just described a classroom as a system. Students go marching into the classroom like so many windup toys, and they come marching out again. Something happens to them in the process. They get older. Perhaps they get abler.

The process, we know, is not simply a ballistic wind 'em up and let 'em march process, but rather a guided process. Educators adjust the process, somewhat, based upon the responses of the students. Symbolize the guidance by a line running out from the output side of the rectangle and straight down about 2/3 of the width of the rectangle. Make a little circle here and then draw the line from it straight west a ways, and then back north to the input side of the rectangle, and then back east a smidgin into the rectangle. We now have a feedback loop, looping from the output side back to the input side. The little circle is to remind us that the information fed back must be interpreted or used to function as feedback otherwise it is just noise. It must be evaluated, related to values or goals or targets or rewards or reinforcers--the term you use depends upon the academic dialect you speak. Feedback implies direction, purpose, or <u>guidance</u>, and we call this a <u>guided</u> system because of that.

Feedback converts the system from a ballistic one to guided. The processes are no longer ballistic, hit or miss, "Here it is kids, learn it or lump it!" The processes are guided. Behaviors are modified based

upon feedback regarding progress toward goals.

Next, be concerned with what happens when the grads go marching off to Pretoria or wherever they go. Draw another rectangle showing where they go. Draw it east of the first one so that the end of the output arrow just touches the new rectangle. We call it the Receiving System because it receives the outputs; in this case, the graduates of the classroom.

The upper right corner of the receiving system should be drawn a bit strangely so that it looks like the Mississippi River cutting off the northeast corner of Kansas. The crazy corner symbolizes, however, not my birthplace or even my alma mater, the University of Kansas, but rather our incomplete knowledge of the Receiving System.

Students go all sorts of places and do all sorts of things which, fortunately sometimes, we never know about; but they do not disappear into thin air so we draw the Receiving System. If we are wise, we get some information on what happens to them in that wild world out there and symbolize that information with another feedback loop from the east side of the receiving system, down to a level a little below the first feedback loop. Draw a little circle there and then draw the line straight west until it is just below the westernmost line of the first feedback loop. Draw it north from there so that it joins the first feedback loop and shares the path back into the Processing System. The Processing System is the general name given to the first rectangle, the one we are now using to symbolize a classroom.

We refer to the second feedback loop as external feedback because it is external to the first feedback loop and becuase its source is external to the classroom, or the processing system. Its source is the receiving system.

Again, the feedback must be used, evaluated, related to goals, purposes, values, desired impacts, or whatever. The purpose of the external feedback loop is to see how well graduates function in the real world environment of the receiving system. Do they function well? Is their performance well adapted to the environment, does it further adapt to the environment? Have we provided students with adaptive behaviors? Do our students help adapt the environment in constructive ways? That is the sort of information we get from the external feedback loop and one of the reasons we refer to the Total Performance Systems as an adatpive system.

The TPS is adaptive in the sense that the external feedback facilitates adapting the processing system to its environment. The external feedback allows the processing system (here, the classroom) to change to promote better interactions with the environment. The adaptation can involve changing output goals and also, it must be emphasized, changing the environment. Adaptation is always two-way; both the processing system and the receiving system are modified.

The notions of the receiving system and of receiving system feedback are very important to the Total Performance System concept. They give it power and differentiate it from many other systems approach concepts. They make it uniquely useful. To understand why, consider the difference between a guided system and an adaptive system. It might not have occurred to you that you are vitally interested in knowing the difference between a guided and an adaptive system. Let me assure you that you are fascinated by the differences between guided and adaptive systems. You will probably discover that interest any minute now.

The guided system concept is a good one; the adaptive system concept is better. One can take a systems approach to education or to business or to delivery of human services or to management and stop with a guided system. One can stop with a processing system with inputs and outputs and a feedback loop. One can stop short of focusing attention on a receiving system, and on systematic external feedback. In fact, that is the usual way of doing things, especially in education and even in industrial training or so-called human service organizations.

Consider how one might take a systems approach to curricular development in a difficult area such as moral development. Pretend that we have been at it for some time. Pretend that we have gone through a process and gotten the conservatives to talk about the decline of morality. Pretend that we have gotten the liberals to talk about humanistic education and development of personal values. Pretend further that the process involved Delphi methods and task groups and such; all artfully managed to keep the liberals and conservatives from getting into the same room at the same time and dissipating their energy prematurely by talking past one another, hurling epithets in the guise of debate.

Pretend that both groups have come out with recommendations that a foundation support a pilot project to do something about moral development. A carefully managed systems approach might acccmplish all that. The next step would be to have the foundation bring together a group of subject matter expters to decide what must be taught, and a group of humanistic educators and educational technologists to work on developing the curriculum package.

This is a scenario familiar to any who have been involved in what we naievely referred to as the "educational revolution." Some really fine curricular materials came out of such efforts--that is a minor miracle in itself--but they had a rather small impact on education.

From the perspective of hindsight and the TPS, it is not hard to see why.

Consider the nature of the expert. First, as we all know, an expert is a person who lives far away. Second, an expert is a person who knows much more about a subject than any normal person even wants to know. Third, the expert firmly believes that the stuff he or she knows is quite important and that those who do not know it, poor souls, are really quite defective.

Suppose we seclude a group of experts at a conference site. The site is selected to be away from the hurly burly of wordly concerns so as not to stifle their rampant creativity with concerns for how the rest of the world (the receiving system) really operates. If the conference is properly run, the experts will hammer out a set of recommendations. Each expert, in private, will assure us that he or she could have made better recommendations if not impaired by the others.

The materials developers then take over and produce materials. They will confide that the materials are pretty good given the inadequate budget, insufficient time, and unrealistic and conflicting demands of the content experts. The materials have clearly stated objectives, related evaluation measures, progress indicators, remedial loops, enrichment branches. They are field tested and meet 90/90/90 criteria, have low error rates, and are cost-effective when used according to the teacher's manual. It's a systematically developed course with a good feedback loop. Students come marching in, get the flexibility offered, somewhat individualized learning experience and learn the material. Then they go marching off into the sunset, filled with everlasting knowledge and live happily ever after. Right?

Wrong! The environments of the subject matter experts are such that they support all that knowledge and behavior. The receiving system for the students is vastly different. For example, the psychology courses I took were vocational training for me and the knowledge supported by one or another part of my receiving system, but I have to tell you that the same behaviors are not functional for most students. Those of us who have been given vocational training--that describes the faculty of any university--like to tell our students that knowledge for knowledge's sake is great and they should not be so vocationally oriented! We are ignoring the receiving system for students.

Now, I think we can agree that a guided system model is better than a totally unguided model. Expert-consensually-validated objectives and feedback-guided effectiveness-validated instruction is preferable to unvalidated, haphazardly guided instruction. But misguided instruction is not the answer. We need something better than a guided system paradigm.

The Total Performance System concept provides a better paradigm. The paradigm is better because of its emphasis upon the receiving system and feedback from the receiving system.

Let's return to the curriculum development scenario to illustrate how to build in more contact with the receiving system. Suppose we ask the cloistered experts if their goal is to have students learn the material and then forget all about it. That is not the goal, they will usually agree, but merely an all too common outcome caused, no doubt, by deficiencies in student character.

If we ask, "Would you rather take on the more challenging task of helping assure that students remember and use what they have learned?", the experts will, by and large, say yes. Educational technologists will be pleased. They might even talk enthusiastically about teaching for

transfer. Transfer--from where to where? From inside the classroom to outside, from the processing system to the receiving system!

The TPS, as a conceptual tool, seems to make sense to most people who play with it a bit. People will say that getting the data from the receiving system is costly and time consuming but everything else being equal, a good idea. Teaching for transfer is "old wine" but when put in the "new bottle" of the TPS it brings out its full flavor.

Drawing a great big receiving system certainly calls attention to that part of the paradigm. Having noticed the receiving system, what do we do about it? Consider a 4th grade classroom. What is the receiving system for a 4th grade classroom? Among other things, a 5th grade classroom. (That is where some of the students go after 4th grade.) So, to run 4th grade as an adaptive system, a feedback from the 5th grade-next-year is needed. But what is the receiving system for 5th grade? Sixth grade. So to really do 4th grade we need feedback on 6th grade-two-years-from-now. And so on.

That makes it tough. Preparing 4th graders well for a lousy 5th grade experience is not an uplifting goal. On the other hand, should one just wait for the 5th grade teachers to get their act together? And should the 5th grade teachers just sit idly and wait for the 6th grade teachers to get their act together? And so on, through school? Should I wait until my boss gets his act together before I start getting my act together? Such a strategy smacks faintly of procrastination. I rather doubt that the president of a university is capable of getting his/her act together if faculty members sit idly waiting for someone else to solve their problems. I seriously doubt that the chief executive officer of a business or the superintendent of a school system can get her/his act together without a lot of support

from below. Alphonse and Gaston are charming, but the Alphonse-Gaston organizational development strategy is not notably successful.

The recommended strategy is the time honored "Get your own house in order!" strategy. Aided by the TPS concept we can see how to hook up our house ordering with that of others so that progress occurs with fewer setbacks.

The strategy is to get your house or your sandbox or your business or your life or your department or your classroom to function as much like an honest-to-goodness adaptive system, as much like a TPS, as possible. Get your part to function as a TPS. When it does, you can hook it more readily into the rest of the system as the rest of the system shapes up. To do that, you look first outward at the receiving system, then inward.

Looking outward--the curriculum guides for the 4th grade show roughly what someone thinks should be accomplished from the time the students come marching in from 3rd grade to the time they go marching out to 5th grade. That is part of looking outward to a receiving system. And there is an immediate receiving system that is very important: the art teacher, the reading specialist, the math coordinator, the playground supervisor, the room mother, the principal, the parents, etc.

The teacher will get some flak from this year's receiving system. Wise teachers convert some of the flak to feedback and seek out other feedback to counterbalance the flak.

Note that a good teacher is a good supervisor and a good manager. Note also that a good supervisor or manager is a good teacher. Consequently, what I have said so far has clear parallels in other organizations.

Teacher and supervisor behavior tends to be guided rather than adaptive. Their behavior is guided by peer reinforcement of behaviors modeled by other teachers and supervisors. The teachers and supervisors. The teachers and supervisors get feedback (from self and some parts of their receiving system) on their performance rather than on the "natural" consequences of that performance. Does what they do correspond to somebody's check list or concept of "good teacher behavior" or "good supervisor behavior"?

But if we view the teacher and the supervisor in TPS terms we ask, "What are the desired consequences of the behavior on the primary receiving system for that behavior"?

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Insert Figure 2 about here.

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To answer that question, let's look at teacher and supervisor as TPS's. Label the processing system rectangle "teacher" or "supervisor". The inputs are curriculum guides, students' work, etc. The outputs are lessons presented, corrected work, and such. Now, what is the primary receiving system for the lessons and corrected work? If you say "students", you are in tune with my thinking. If you say "the principal" you have specified an important and not to be ignored part of the receiving system.

For the supervisor, the inputs are the work schedule, requests for information and such. The outputs are instructions to subordinates, completed reports and such. The supervisor's receiving system is the work group, immediate boss, and less immediately, other parts of the organization.

The internal feedback loop for the supervisor might be self-talk, perhaps guided by a supervisory behavior checklist or a checklist of things to do today. The internal feedback loop for the teachers is similar. "Am I following today's plan?" "Am I doing what I set out to do?"

The external feedback loop for the teacher describes student performance: "Are students performing up to their ability, up to standard?" "Is what I'm doing resulting in good student performance?" The external feedback loop for the supervisor relates to worker performance: "Are they performing according to schedule or up to standard?" "Is what I'm doing resulting in good worker performance?" Notice that the external loop furnishes validation for the teacher or supervisor performance goals.

To say that in another way, internal feedback relates mostly to the performance of the teacher or the supervisor. The external loop relates more to the consequences of that performance "Does it facilitate achievement of the students or workers?"

Teachers have known for a long time that educating the whole child, developing the child's total capabilities is more important than getting today's lessons done. Teachers are in the human resources development business and not in the business of seeing to it that workbook pages get nicely filled. Supervisors, too, are in the human resource development business. They must get today's widgets out but know that doing so at the cost of alienation of the work force is not good business.

The student and the worker are more than workbook fillers and widget makers: They are vital human resources; they are the bricks out of which the classroom or the work group are fabricated. They

are the bricks; feedback systems are the mortar. They are the elements; feedback establishes the relationships that make them into a class or a group.

We must establish proper feedback systems to enable the individuals to function as adaptive systems, as TPS's. Only then and only thereby can we have a really effective and adaptive classroom or work unit. The TPS concept is essential.

Behavior analysts often ask me why we need the TPS concept to get classrooms or work units to function well. Can't we do that with contingency management?

My answer is a diplomatic "yes and no". "Yes" because we must manage contingencies, and "no" because we need the TPS concept to guide our attempts to manage contingencies.

You can really go a long way with the concept of the contingency of reinforcement, but there are a few problems. One set of problems is determining goals, determining what behavior ought to be reinforced. What behaviors would be functional in a particular environment? Of those that would be maintained, which are functional over the long term as opposed to the short term? That is a difficult set of problems. The TPS concept is useful in dealing with them in that it emphasizes the environment (receiving system) and feedback from it, putting system-environment interactions clearly in the picture.

There is another tough set of problems. Any behavior analyst remotely worthy of the name can find all sorts of things wrong with the contingencies in a school, human service, agency, business, or industrial concern. If someone hands us control of the relevant reinforcement contingencies, we can often manage those contingencies reasonably well; but we have some trouble getting someone to hand us the control over the contingencies.

Even if we get someone to give over a set of contingencies, we have trouble getting the new contingencies to remain in effect for long periods. We design new contingencies for improving student or worker behavior and they stay in effect only as long as we are there to reinforce the teacher or supervisor. Noting this, we get the principal or a second level manager to reinforce the teacher or supervisor. That works only as long as we are there to reinforce the principal or manager. Rather than pausing to consider whether we have failed to find worthwhile functional behaviors, we try to reinforce someone for reinforcing the principal or manager.

We have some success--at least as much and probably more than most other organizational development people. The image is a little silly, though. The image is of a teacher standing behind Johnny uttering "Good reading, Johnny!" Standing behind the teacher is the principal uttering "Good teaching Mr. Chips!" A superintendent stands behind the principal uttering "Good principal behavior, Ms. Pim!" And there is a shadowy figure in the background standing behind the superintendent saying, "Good superintending!"

Perhaps that shadow figure is you or I, reinforcing the superintendent periodically before dashing off to a convention so an audience can say "Good contingency managing!" to us.

There is something less than elegant about the image of several people queued up behind Johnny to assure that his reading behavior is properly reinforced! The image, I am afraid, is only a slight caricature of what we sometimes do. Nevertheless, the total job must be done to assure that contingencies are properly managed for each contingency manager. Perhaps our practice would be improved if we noted that the contingency management job is a normal part of the traditional "direct and control" function of the "plan, organize, direct, and control" job of managing. Our attempts

at contingency management without attending to the system's routine management are ludicrous. But so are the attempts of the traditional manager or teacher who operates without knowing how contingency management works. The ludicrous part of what we do can be largely corrected by using the best of what traditional managers or teachers do. The ludicrous part of what traditional managers or teachers do can be largely corrected by using the best of what we do. The TPS concept is one which can form the bridge to synergism if we choose to use it.

We need to do that because the task of keeping contingencies in place long enough to get the system to stabilize and maintain the new contingencies is a difficult one. The problem, I think, is well described by Simon's parable of the clockmakers. Simon, who received the Nobel Prize for Economics last fall, described the parable almost twenty years ago in a frequently reprinted article called "The Architecture of Complexity".

The parable is about two master clockmakers, Hora and Tempus. Each was a craftsman who built and sold fine clocks. Each began his clockmaking business working all alone running a little clock shop tucked away, I suppose, in a village in the Alps. By coincidence--or rather because it is important to the parable--each clockmaker's clocks were complex devices made from 1000 parts.

Tempus' clocks were delicately assembled by putting pieces together one by one, holding them carefully in place until 999 were assembled. The 1000th piece locked the mechanism together and it, thereby, became a clock. Tempus could assemble them rapidly and skillfully. Occasionally, perhaps, he would sneeze after five or six hundred pieces were assembled and lose his grip. The pieces would all fall apart and he would have to start over. That rarely happened, though; he was a master clockmaker.

Hora's 1000 piece clocks were assembled in a different way. He made 10 piece subassemblies such that the 10th piece locked the subassembly together. He would make 10 subassemblies which could be locked together into a 100 piece subassembly. Ten 100 piece subassemblies were constructed so that they could be fit together into a 1000 piece clock. If Hora sneezed at most 9 pieces fell apart. He rarely sneezed, so that was not important.

Hora and Tempus both made excellent clocks and made them equally rapidly. Tempus may have been a little faster, but the difference in sneeze consequation evened things out. Both clockmaker's clocks sold well and that is what produced the problem for Tempus. Success spoiled Tempus' business.

As word spread about the excellence of his clocks, people would come into the shop to buy them. Tempus had to literally drop what he was doing whenever a customer came in. As demand grew the supply got smaller, because with all the interruptions, Tempus just could not build enough clocks. (The price, however, was held down by the competition. Tempus lost customers to Hora.)

Tempus' plight is similar to that of the organizational change agent. When business is slow the change agent can flit around like a one armed paper hanger and hold the whole thing together with personal charm and social reinforcement. But as clients find our charms more and more resistable or business picks up, we run into trouble. We begin work on a second department or in a second company and we cannot always hold it together anymore. Something slips and the contingency management system we have so carefully put together falls apart.

Tempus' approach is exhilarating in some ways, calling upon the best of our craftsmanship, but it just does not do the job in the long run. Hora, on the other hand, can handle prosperity. As demand increases, he

can keep building clocks because all he has to do is 10 operations between interruptions. And, of course, it would be easier to train helpers. Putting together a 10 piece subassembly requires less craftsmanship than putting together a 1000 piece clock.

Simon goes on, in the article, to show that Nature's way of building complex systems is Hora's way. Build subassemblies and hook them together. In other words, complex systems are built from building blocks which are themselves systems.

To evaluate, design, develop, and manage complex systems we need a building block which, itself, is a system. The Total Performance System is a general model for such a building block. It can serve as a unit for analysis and as a building block for synthesis. If we use the TPS concept to analyze and describe the functioning of a total organization, we can use it to guide our efforts to identify the contingencies of survival, the contingencies for growth, the contingencies for happiness of that organization.

Let us return to the 4th grade classroom and to the work group to find the remaining building blocks, the little TPS's and see how to fit them together into larger TPS's, to see how to get the parts to fit together as a whole, to see how to fit the elements into a system, doing it Hora's way.

Label the processing system "Student" or "Worker". Inputs to the student are lessons or assignments; outputs are completed lessons and related actions. Inputs to the worker are materials or work to be done; outputs are completed work and related behaviors. Processing system feedback is self-talk about "How I am doing", and feedback generated by the task itself.

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Insert Figure 3 about here.

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The receiving system for the student is the teacher and peers, and, perhaps, parents. For the worker, it is the supervisor, peers, and, perhaps, quality control or the next part of the organization. Receiving system feedback, I am sorry to say, is usually infrequent, fragmented, and conflicting.

We all know about peer punishment of rate busters, apple polishers, and eggheads. We all know that erratic reinforcement maintains erratic behavior. And we all know that it is physically impossible for a teacher or a supervisor to provide all the feedback and all the reinforcement necessary to maintain high rates of productive behavior.

In industry and education, we attempt to solve the problem by work design. We design jobs and aids, we design instructional material and learning aids to be as self-explanatory as possible. We sometimes do too well and make the jobs or lessons too simple so that attending behavior is not reinforced and workers or students exhibit resultants we call inattention and boredom.

If we spend a lot of energy on design, we can reduce the magnitude of the problem but we cannot eliminate it. There is too much variation within jobs and between individuals. That is why we need to consider students and workers as participants with a significant role in the educational or supervisory process.

The TPS can help to define that role and can help us see how to integrate several workers into a work unit or several students into a class. Consider first the internal feedback loop. Think of it as self-evaluation. Think of it as internal or personal standards. Think of it as intrinsic feedback from the lesson or job. Think of it as pride in workmanship. Think of it as guiding self-talk. Think of it as reinforcing self-talk. Think of it as the primary source of immediate reinforcement. The internal feedback loop symbolizes something

very important that gets talked about in a lot of ways.

Now consider the external feedback loop. What is the receiving system for the outputs of the student or worker? The teacher, the supervisor, peers. The external feedback loop represents feedback from them. Now, what is the major function of the external feedback loop of the TPS? The external feedback is a way of evaluating and validating internal feedback.

The external feedback is an external control to balance and maintain internal controls. Think of the external feedback to the student or worker then, as having a major role in shaping and maintaining a functional internal feedback.

This point is an extremely important one for the teacher or the supervisor: external feedback has a major role in shaping and maintaining functional internal feedback. We know that to learn, to perform well, a person benefits from frequent and immediate feedback. We know that, as a practical matter, it is difficult, if not impossible, to provide enough immediate positive reinforcement. The difficulty is two-fold: (1) The timing of reinforcement delivery is critical and requires observation of performance trends. (2) Reinforcers are private events, i.e., whether or not some stimulus is a reinforcer depends upon each person's reinforcement history and current deprivation states. The history, and most of the deprivation states, are out of the control of the supervisor or teachers.

They are, or can be, somewhat more under the control of the student or worker.

The only way I know of to deliver a good schedule of reinforcement to a student, or to a worker, is to use feedback and reinforcement from the teacher or supervisor to facilitate internal feedback or reinforcement. If supervisors and teachers prompt and reinforce accurate self-evaluation and timely self-reinforcement or reinforcement seeking behavior, they can

solve many motivational problems.

During the last few minutes, we have viewed a teacher and a supervisor as TPS's and then gone on to view the individual learner and worker as TPS's. Here is some data from a 4th grade classroom. The data are median and inter-quartile ranges for math problems correctly completed by 26 children during one hour math periods. The first set of data are from a "baseline" period in which percent correct was plotted on a wall chart which showed the datum for each student. Median number correct is about 6 (5.7). The second set of data are from a time when number correct were posted on wall charts for each child. Median number correct is about 24 (24.625). The third set of data are from a time when the teacher recorded number correct on a chart at her desk rather than have the children post their scores on the wall chart. Median number correct is about 10 (9.75). The fourth set are from a time during the last days of the year when use of the wall chart was reinstated. Median number correct is about 23 (23.4).

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Insert Figure 4 about here.

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The design is a slightly screwy ABAB design. It shows the effect of changing feedback conditions. Putting the teacher's record book on the wall where it can provide performance information to the children is more productive than keeping it at her desk.

Anticipating some questions--Did graphing percent correct in the first condition increase accuracy? Probably. Percentage correct increased. What happened to accuracy when percent correct was replaced by number correct? There was a slight drop in percent correct upon switching to feeding back number correct, but percent correct remained at around 80%. (A problem had to be correct to be counted and the teacher instituted an accuracy contingency

allowing students with high accuracy to skip some of the problems.) Are the group data representative of individual performances? Yes. All 26 increased number correct when the wall charts were instituted for number correct. Twenty-five of them reduced number correct when the wall charts were not used and all 25 increased again when the charts were reinstated. The 26th person simply increased performance steadily after the graphs were introduced. Neither the teacher nor I was displeased by that small failure to establish external feedback control.

One thing these data show is that providing the performance data to the students is useful. The teacher had essentially the same type of student performance data throughout, so the changes are not attributable to changes in that receiving system data to the teacher. Similarly, each student received daily information on her or his correct work throughout the entire period. Posting the data on wall charts was one operation, but it had two potentially important and differentiable effects from the persepctive of student as total performance system: (1) It changed the internal loop, the processing system feedback from performance data given daily to performance data on trends. It gave the students a clear "memory" so that they could compare today's performance with yesterday's, last week's, etc. Any good behavior shaper knows that it is important to know whether a given response or set of responses is closer or farther from the target level of performance. Posting the wall charts made a potentially significant change in processing system feedback. (2) Posting the wall charts made potentially significant changes in receiving system feedback as well. (a) It made it easy to compare "my" performance with that of my peers. (b) It provided an occasion for peer reinforcement and peer punishment. (c) It provided an opportunity for competitive or supportive peer behaviors to be established.

Ten years ago, when I did this study, I was interested only in assisting the teacher with some real classroom problems and, thereby, showing that the TPS concept was a useful tool for describing and for modifying classrooms. I am presenting these data to carry that message once again and to emphasize that the TPS concept can be a useful tool in design to do component analysis in complex living systems. The TPS concept can help one tease out the components and then guide doing the studies. In the example just given, the one operation of hanging the charts on the wall made at least one change in processing system feedback by making it easier to see individual performance trends and it made several changes in receiving system feedback by making it possible to get precise comparisons with others' performances. The changes could be separately observed and analyzed and even manipulated as independent variables.

Recall also that the TPS is an adaptive system and notice some other research possiblities that are highlighted. Adaptive systems set goals: Personally productive goal setting is something we might want to encourage in students and workers--not to mention teachers, supervisors, and managers! The presence of the individual performance data, displayed over time so that trends are discernable, makes goal setting easier.

The teacher or supervisor can model goal setting behaviors, lead discussions for total group production goals, discuss individual performances, selectively reinforce and shape peer discussion, and so on. Those of you who know how to get participative management or management by objectives to work might recognize the techniques. Having the data and recognizing that the superior behavior is to facilitate goal setting behavior rather than to impose goals is a great help. The TPS concept highlights some of the behaviors which

are probably critical and provides a perspective for doing some of the component analysis. For example, wouldn't it be amusing to discover that those are right who insist that maintaining all those graphs just to reinforce behavior is more work than it's worth? And wouldn't it be amusing to discover that the real reason the graphs work is that they are functional in facilitating personal goal setting and thereby enhancing so-called intrinsic reinforcement?

When you draw a TPS, all you see is some lines on a surface. Only when you start trying to relate those lines to real world systems and real world problems, only when you start relating them to what you know about educational theory or management theory, only when you start relating them to problems that have perplexed you, only when you start using them to guide and organize your analysis behavior, only when you start using them to guide and organize your research efforts, only when you start using them to guide and organize your creative problem solving behaviors, only then are you ready to see why it is worth drawing those silly lines, why it is worth trying to frame your responses in the Total Performance System format. It is habit forming, perhaps addictive, because it increases the probability that your analyses will be on target and your designs productive. At least that has been the experience of some.

Trying as I am to make the TPS related behaviors in[illegible] a positive addiction, let me describe further the nature of that addiction. I said at the beginning that the TPS is a special kind of concept, a unit of analysis. The claim was that the TPS is a unit of analysis for systems analysis akin in power, precision, and generality to the contingency of reinforcement as a unit for doing behavioral analysis. That is really a grandiose claim. I am not sure I fully believe it yet. The claim is heuristic at this point, being staked out to see if it can be defended.

Teh TPS is simple enough to be comprehensible and general enough for wide applicability. It is simple: There are seven, plus or minus one, parts to it. (Six if you count the processing system and receivng system, 2, internal and external feedback, 4, and inputs and outputs 6; there are eight parts if you recognize that internal feedback requires objectives and external feedback requires goals.) Those six or eight parts are sufficient to describe an adaptive system. And adaptive systems are those which are complex enough to monitor the effects on environment and on self of system-envionrment interactions. That is something that we as individuals do when we unhook from short term reinforcers to adapt to long term reinforcers. That is something we as a culture must do if we are to survivie. The contingency of reinforcement is the individual response unit for analysis of system-environment interactions. The TPS is the subsystem or system unit for analysis of system-environment interactions.

If you want to understand a complex system such as a classroom, use the TPS concept to look outward at the environment of the classrooms--what outputs will that environment support? What outputs will it accept in exchange for resources needed for the continued survival of the classroom? What are the consequences to the classroom and to the environment of producing and receiving those outputs? (In some sectors we call that marketing research, in some sectors we call it assessment of community needs, in some sectors we call it assessment of technological impact. Whatever it is called, it is important and the TPS concept makes that importance visually obvious.)

If you want to understand a complex system such as a classroom, you can also use the TPS concept to look inward at the adaptive systems which comprise the classroom. Look at each staff member as a TPS. Look at each learner as a TPS.

Everywhere he or she looks, a moderately well trained behavior analyst can see contingencies of reinforcement. I suggest to you that if everywhere you look, you see also the TPS's whose behavior is governed by sets of those contingencies, you will have a much better chance of modifying them constructively and in ways which endure. As you know, getting people to see beyond their old concepts, beyond the past and all the way to present contingencies is difficult. Getting people to see beyond immediate contingencies and at least part of the way to long term contingencies is difficult. And getting some teachers and some managers to see all the way from long term contingencies down to the nitty gritty of short term contingencies is difficult.

When you draw the little rectangle called the processing system, you call attention to short term contingencies and you draw a box which captures much of the traditional or parochial or self-centered view. When you look outward and draw the receiving system it calls attention to that world out there. It calls attention to other and critical evaluators and to the all too common lack of receiving system feedback.

When you look inward and draw workers and students as TPS's, it is a little easier to see them as resources rather than problems. It is easier to see them as wholes rather than as hands for turning out widgets or ears for listening to whatever we have to say. It is easier to see that they have multiple goals and multiple sources of external feedback and reinforcement. It is easier to remember the internal locus relevant to personal goals, to remember that the goals are different and sometimes conflict with teacher or boss or system imposed goals. It is easier to see that learner centered instruction is not a cop out but a potentially effective, even essential way to achieve educational goals of all sorts. It is easier to see that participative management is not a cop out by soft headed managers, but a potentially effective, even essential way

to achieve organizational goals in a changing world. It is easier to see that different parts of an organization have different appearing but functionally similar problems. It is easier to wear someone else's moccasins, to see that if I were in <u>that</u> processing system box rather than in <u>this</u> processing system box, I would behave <u>that</u> way rather than <u>this</u> way. (That way is adaptive in that box, this way is adaptive in this box.) It is easier to accept the notion that different strokes are needed if you use the TPS concept to show the different strokes from a common perspective.

The Total Performance System is the solution.

Or so I would have you believe.

Figure 1

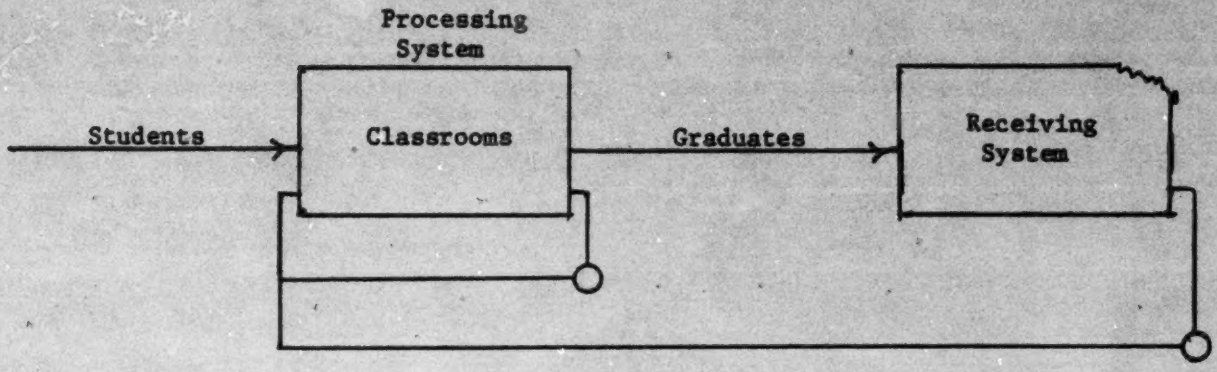
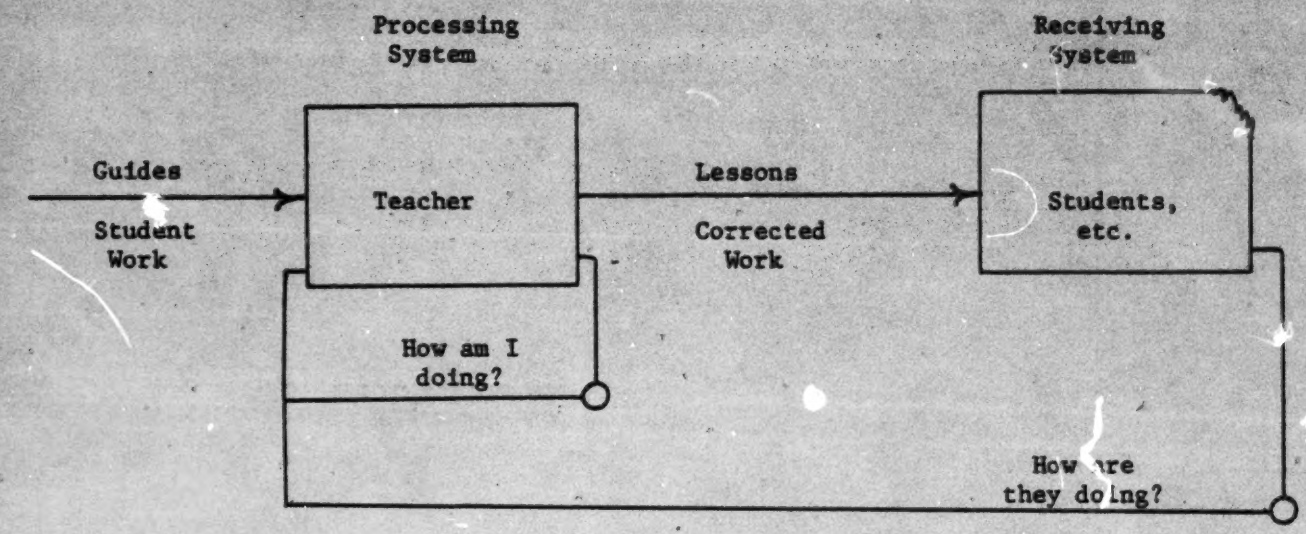

Processing
System
Students
Classrooms
Graduates
Receiving
System

Figure 2


Processing System
Receiving System
Guides
Student Work
Teacher
Lessons
Corrected Work
Students, etc.
How am I doing?
How are they doing?

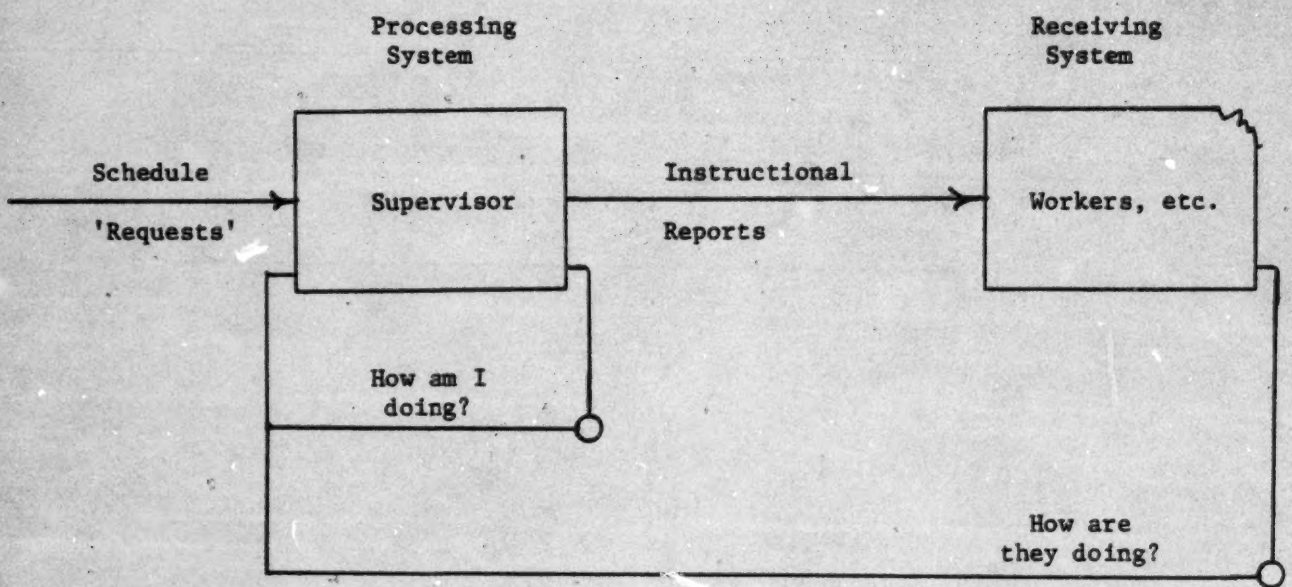

Processing System
Receiving System
Schedule
'Requests'
Supervisor
Instructional Reports
Workers, etc.
How am I doing?
How are they doing?

Figure 3

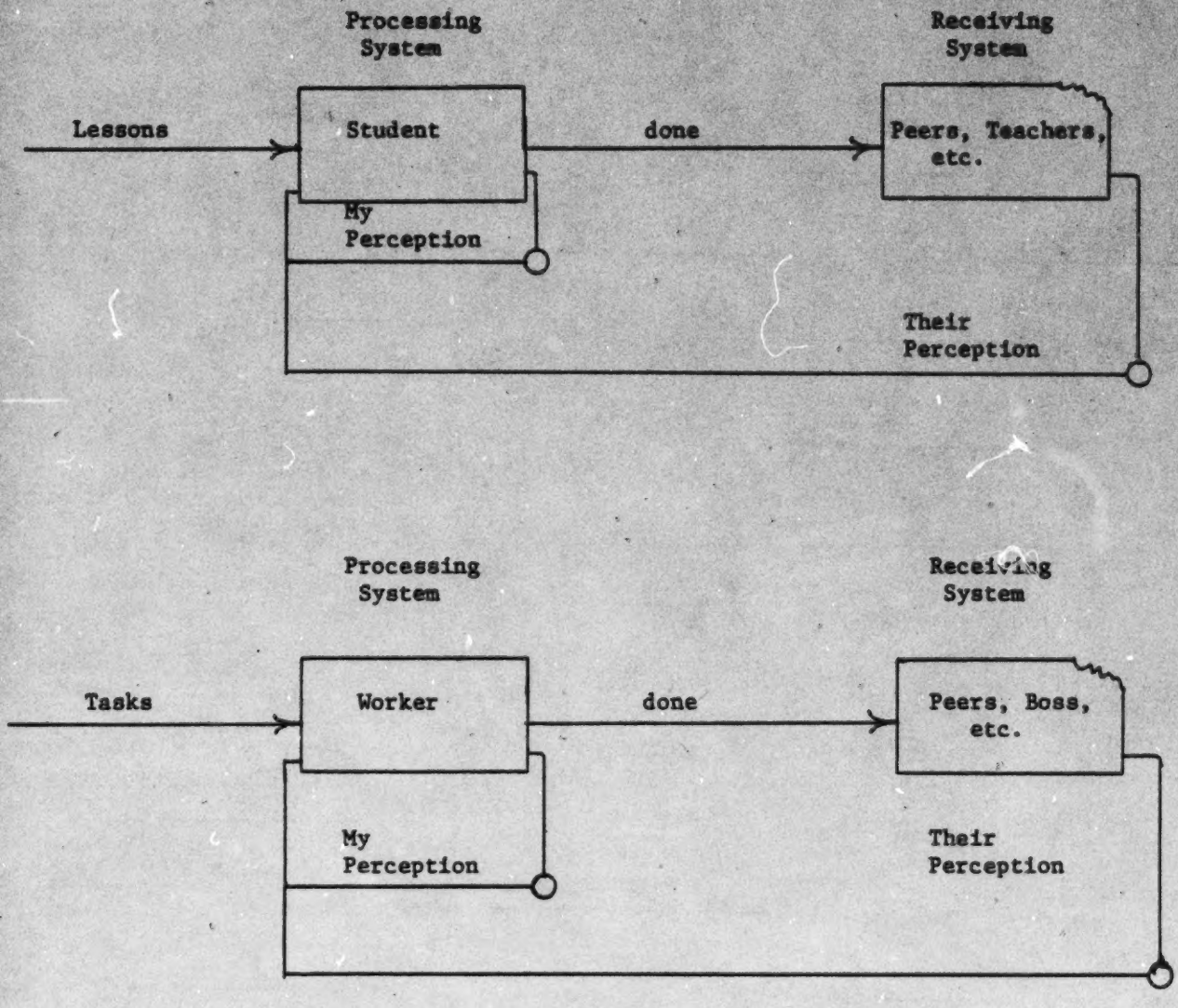

Processing System
Receiving System
Lessons
Student
done
Peers, Teachers, etc.
My Perception
Their Perception
Processing System
Receiving System
Tasks
Worker
done
Peers, Boss, etc.
My Perception
Their Perception

Figure 4

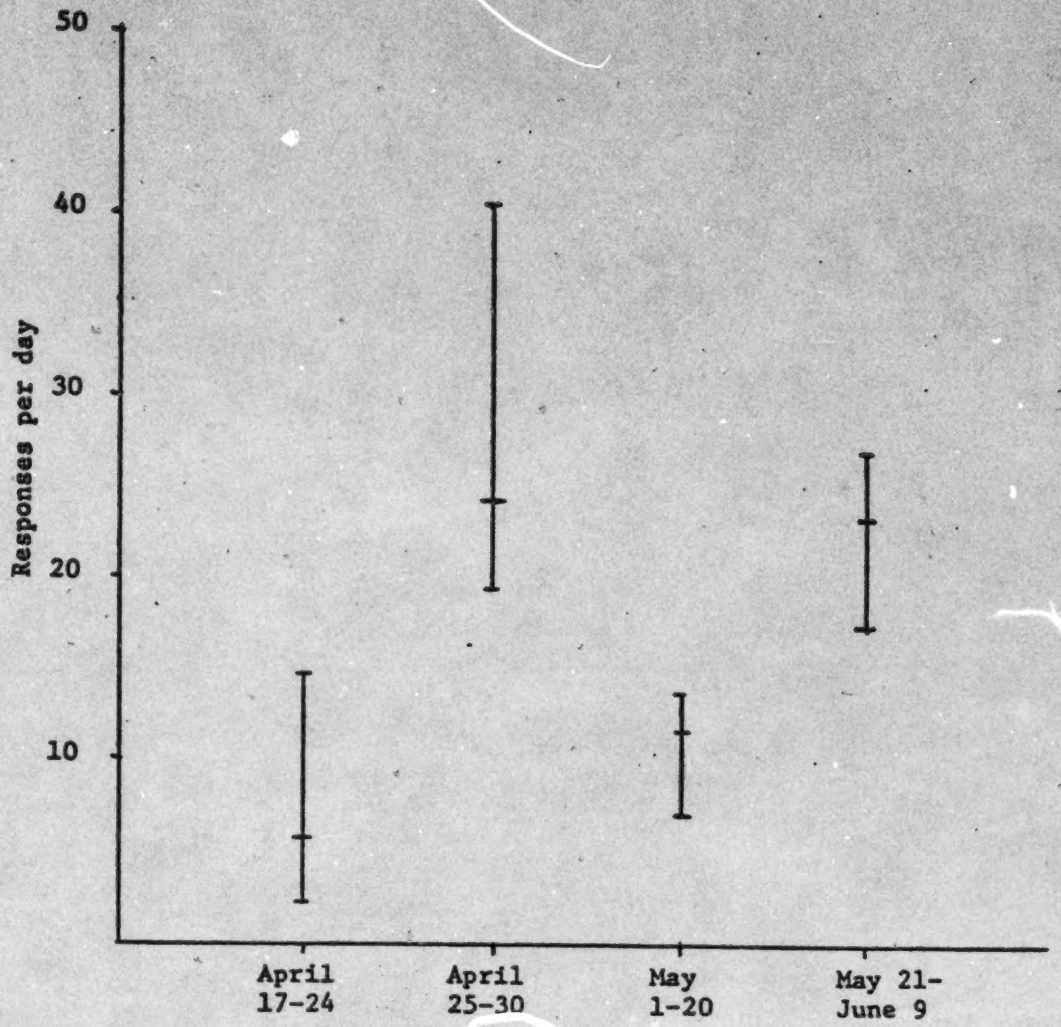



Figure 3 Median and inter-quartile range of correct response rates under different feedback conditions